9 January 1963

MEMORANDUM FOR: Chief, Dissemination Control Branch, DD/CR

FROM : Chief, Publications Staff, ORR

SUBJECT : Transmittal of CIA/RR EP 62-86, Production of Industrial and Scientific Electronic Equipment in the USSR, 1950-65, December 1962, Secret

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✓ #15 Assistant Chief of Staff, Intelligence
Department of the Army, Mail and Records Branch, Receipt and Dispatch Section, Room 2B-545, Pentagon
Attn: Miss Dorothy Runge, Military Industrial Dept., US Army Area Analysis Intelligence Agency, Army Map Service, 6500 Brooks Lane

✓ #16 Director of Naval Intelligence, Room 5B-659, Pentagon
Attn: Lt. Jacob R. Holzschuh, STIC-1E3, Bldg. 52, Naval Observatory

✓ #17 George A. Zappala, AFIC (AFCIN-3R1), Headquarters, USAF, Bldg. B, Arlington Hall Station

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✓ #19 Mr. Charles F. Boehm, Dept. of Commerce,
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Attn: Donald S. Parris, Action Director,
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7 Attachments

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PRODUCTION OF INDUSTRIAL AND SCIENTIFIC ELECTRONIC EQUIPMENT IN THE USSR 1950-65

December 1962

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CENTRAL INTELLIGENCE AGENCY

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PRODUCTION OF INDUSTRIAL AND SCIENTIFIC ELECTRONIC EQUIPMENT IN THE USSR 1950-65

CIA/RR EP 62-86

December 1962

CENTRAL INTELLIGENCE AGENCY

Office of Research and Reports

FOREWORD

For purposes of intelligence analysis the electronics industry of the USSR is divided into five major sectors.* This publication represents an attempt to assess the size and composition of that sector concerned with production of electronic equipment for industry and science.

The rapid expansion of the use of electronic techniques in industry, coupled with the constant emergence of new product types and the application of these to wider areas of industrial work, has made the industrial electronics field very difficult to assess statistically, even in the US. In the USSR a similar statistical uncertainty is noted in that Soviet published materials relating to industrial electronic equipment have not provided a coherent picture of the status of the sector. Considerable confusion exists in Soviet practice in the statistical handling of production information. It is believed that the statistical ambiguity derives as much from the complexity of the problem -- that is, from the lack of homogeneity of products and the absence of a centralized production authority -- as from a policy of conscious concealment of data for security reasons.

In spite of these difficulties, it is necessary at this time to attempt an initial and provisional intelligence assessment of the magnitude of the Soviet effort, inasmuch as this assessment not only will provide a better understanding of the industrial electronic sector, including identification of important gaps in information, but also will assist in the development of better estimates for the residual sectors of the industry.

* Consumer entertainment equipment, commercial communications and radiobroadcasting equipment, military electronic equipment, electronic components and materials, and industrial and scientific electronic equipment.

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PRODUCTION OF INDUSTRIAL AND SCIENTIFIC ELECTRONIC EQUIPMENT IN THE USSR* 1950-65

Summary and Conclusions

The USSR produces a wide range of industrial and scientific electronic equipment** the value of which in 1961 was 208 million rubles,*** or about 5 percent of the total output of the Soviet electronics industry. The industrial sector includes various types of equipment classed generally as computers and related equipment, radio measuring instruments, industrial control equipment, and medical and scientific equipment. Manufacture in series production of a major part of the electronic equipment in the industrial sector has been a relatively recent development in the USSR. A rapid expansion has been possible, therefore, in output of the sector, averaging more than 38 percent annually from 1950 through 1958. Moreover, additional requirements for computers, electronic instruments, and industrial controls, which are implicit in the plans for expansion of the use of radioelectronics throughout the Soviet economy during the Seven Year Plan (1959-65), insure a continued rapid growth through 1965 estimated to average about 23 percent annually. By 1965 the value of output of industrial and scientific electronic equipment will reach 463 million rubles, or approximately 7 percent of the total value of electronic equipment which, it is estimated, will be produced in the USSR in that year.

Electronic computers and related data-handling equipment and radio measuring instruments are the two largest of the major classes of the industrial sector, together representing more than 80 percent of the total. Although the estimated annual growth in output of industrial control equipment of 34 percent during the Seven Year Plan indicates that this is the fastest growing class of industrial electronic equipment, the absolute value of output of industrial control equipment is small and will represent only 15 percent of the total sector by 1965. The growth in output of medical and other scientific electronic

* The estimates and conclusions in this publication represent the best judgment of this Office as of 15 November 1962.

** For definitions of terms and a detailed description of the major classes of the sector, see I, p. 3, below.

*** Ruble values in this publication are given in prices of 1 July 1955 adjusted to the new 1961 rate of exchange established by the Soviet currency reform of 1 January 1961 and may be converted to US dollars at a rate of exchange of 0.6 ruble to US $1.

equipment is relatively slow, about 15 percent per year -- a level about equal to that for the total electronics industry during the Seven Year Plan.

The absolute magnitude of output of the Soviet industrial electronics sector in 1958 was about one-fourth of that for a comparable US sector; and, in spite of the larger annual rate of growth in the Soviet sector, industrial electronics in the USSR by 1965 will have reached a level comparable to that in the US for the year 1956. Output of the Soviet industrial sector as a part of the total electronics industry also has lagged behind that in the US and will not reach until 1965 the relative portion (7 percent) that prevailed in the US electronics industry in 1956. Moreover, in most types of industrial electronic equipment the design of US equipment in series production represents a more advanced level of technology than that in the USSR. Partly to overcome the lag in technology, but also to supplement insufficient domestic production, the USSR imports industrial and scientific electronic equipment from East Germany, Czechoslovakia, Hungary, and countries of the industrial West.

The major factors that have prevented the USSR from manufacturing industrial electronic equipment which is adequate both in quantity and in quality have been (1) insufficient investment in new production facilities, (2) the absence of established standards, (3) problems in coordination between research and manufacturing facilities, and (4) the slow pace of introduction of new equipment into series production. In addition, the development and production of industrial and scientific electronic equipment in the USSR has been slowed somewhat by the tight supply of electronic components which prevailed in the USSR during the first half of the 1950's and the relatively low priority afforded to the industrial sector until the Sixth Five Year Plan (1956-60) and the subsequent Seven Year Plan (1959-65). Since 1960 a greater number of types of industrial electronic equipment have been designed around the use of semiconductor devices. This extended use of semiconductor devices and a similar increase in use of printed circuits, along with the use of standardized component units for power supplies, radiation sources, recording, data read-out, and so on, is expected to assist in achieving the increased productivity in the manufacture of industrial electronic equipment which is called for during the remaining years of the Seven Year Plan. In spite of these developments, however, output of the industrial electronics sector will not have reached the desired levels by 1965, and the USSR will continue to import this equipment from present sources.

I. Definition of the Industrial Sector

The term industrial and scientific electronic equipment, or industrial electronics, is used in this publication to describe the wide range of electronic equipment for which the end use is primarily industrial or scientific as opposed to electronic equipment which is designed primarily for military or consumer entertainment end use or for commercial communications. The industrial and scientific sector of the electronics industry is referred to also as the industrial electronics sector or the industrial sector. A general definition of the industrial electronics sector by end use raises problems because it is not always possible to determine precisely the end users of universal types of electronic equipment such as electronic computers and electronic test and measuring instruments. For convenience in analysis, however, it is necessary to treat certain classes of equipment as totally within the industrial electronics sector when the principal end user in the USSR is Soviet industry or science. The industrial sector is therefore further divided into the following four classes of electronic equipment: (1) radio measuring instruments, (2) industrial control devices, (3) medical and scientific electronic equipment, and (4) electronic computers with their related data-processing equipment.

1. Radio measuring instruments are precision instruments incorporating electronic components used to measure, record, or display either electromagnetic signals or the electrical parameters of electronic components and circuits. This class of equipment includes a large variety of measuring instruments such as oscilloscopes, signal generators, phase meters, vacuum tube voltmeters, and electron tube or semiconductor testers.

2. Industrial control devices are defined as those electronic devices which measure, amplify, process, record, or relay sensings in an industrial process for purposes of facilitating the control of that process by automatic or semiautomatic means. This class of equipment includes industrial X-ray equipment used in detecting internal flaws in solid materials, castings, or joinings; radioactive isotopic instruments used on the production line in processing materials primarily to measure rates of flow, density, and thickness; industrial television for monitoring activities in inaccessible areas; and a large number of other functional devices, which process instrument sensings, actuate controls, or record data to effect control of operations in an industrial process.

3. Medical and scientific electronic equipment is a general class of equipment made up of geophysical and meteorological instruments,

medical equipment, and other nonstandard laboratory instruments developed for use in scientific research. Geophysical and meteorological electronic equipment includes radioactive isotopic and ultrasonic instruments for prospecting and sampling geological formations as well as radiosondes for gathering and relaying meteorological data from the earth's atmosphere. Medical electronic instruments are those used in biological research and in diagnostic and therapeutic treatment. These include medical X-ray equipment, fluoroscopic equipment, ultrasonic devices, electroencephalographs, and several new electronic developments wherein electronic assemblies are used either as data processors or as therapeutic agents.

4. Electronic computers and related equipment includes those electronic digital and analog computers, electronic data-logging equipment, and related input and output devices which are employed in industrial control systems, in the processing of economic data, and in computations for scientific research which may or may not have primarily military implications.

Specifically omitted from industrial electronics have been those types of communications and sound reproducing equipment which in recent years have become more widely used by several large sectors of industry. Included in this equipment would be the microwave radio relay equipment and radiobroadcast equipment used by railroads, inland shipping, oil pipelines, and other industries requiring extensive communications systems. Also excluded are commercial sound equipment, public address systems, and intercoms installed in theaters and assembly halls throughout the country. At present the estimated output of such equipment is included in the commercial communications sector.

II. Development of the Industrial Sector

A. Growth

The series production of a majority of products in the industrial and scientific sector of the Soviet electronics industry has been a relatively recent development. In the early 1950's, for example, the major types of electronic equipment in series production which could be included in this sector were radio measuring instruments and medical X-ray equipment. The broadening of the product mix, therefore, has contributed greatly to the rapid expansion in production of industrial electronics in the USSR during the years after 1950. The emphasis placed on the modernization of Soviet industry in the aborted Sixth Five Year Plan and subsequently in the Seven Year Plan implies an ever-increasing use of electronic equipment in all branches of industry. The 1959 Party plenum called for "comprehensive utilization of scientific and technological achievements and discoveries, especially in the fields

of radioelectronics, radioactive isotopes, semiconductors, and nuclear energy." 1/* The 1960 plenary session of the Central Committee of the Communist Party again emphasized this point, calling for a more adequate dissemination of developments in new technology and advanced machinery acquired by the radioengineering industry. 2/ Although the statements of the Party plenums have not been addressed directly to production of industrial electronic equipment, the implications of additional requirements for electronic instruments and industrial controls are apparent in the statements concerning the expanded use of radioelectronics throughout the Soviet economy.

Growth in output of industrial electronics significant to all Soviet industry has come only since about 1958, when the USSR began to emphasize automation in industry and when electronic data processing and other advanced techniques in electronic control equipment created a tremendous demand for industrial electronics. Although annual rates of growth in the industrial sector were greater in the years before 1958 than after, the absolute contribution of electronics to Soviet industry in these earlier years was small and was directed primarily toward supporting the communications industry.

Industrial electronics has never made up a large sector of the total Soviet electronics output. However, as a result of the relatively high annual rate of growth -- that is, an average of 23 percent compared with 14 to 15 percent for the electronics industry -- industrial electronics by 1965 will make up slightly more than 7 percent of the total electronics output. Contributing most heavily to the rapid growth of industrial electronics is the increase in output of electronic computers and related equipment, which is to average about 24 percent annually during the Seven Year Plan and which makes up from 35 to 40 percent of the total industrial electronics sector. The highest annual rate of growth has been achieved for industrial controls. In terms of value, however, industrial controls have been relatively less important, making up only from 8 to 15 percent of the total sector. Growth in radio measuring instruments, on the other hand, has been relatively slow, but the value of output of these instruments has been significantly large and will make up 40 percent of the industrial sector even in 1965. The value of output of the several classes of industrial electronics and the output of the total electronics industry in the USSR during 1950-65 are shown in Table 1.**

B. Comparison of USSR and US

Data on the US output of industrial electronics provides a yardstick against which the Soviet industrial sector can be measured.

* For serially numbered source references, see Appendix D.
** Table 1 follows on p. 6.

Table 1

USSR: Production of the Industrial Electronics Sector, by Class of Equipment, and of the Total Electronics Industry 1950-65

Million 1955 Rubles [a]

Year	Total Electronics Industry [b]	Industrial Electronics Sector					
		Total [c]	Radio Measuring Instruments [d]	Electronic Computers and Related Equipment [e]	Industrial Control Devices [d]	Medical and Scientific Electronic Equipment [d]	
1950	210	8	4.6	1.8	Negl.	1.8	
1951	340	12	6.7	2.7	Negl.	2.3	
1952	490	17	9.8	4.0	Negl.	3.0	
1953	700	23	13.4	6.0	Negl.	3.9	
1954	960	34	19.1	9.0	0.6	5.1	
1955	1,280	48	26.8	13.4	1.1	6.6	
1956	1,680	69	33.5	26.0	2.2	7.6	
1957	2,100	87	41.8	32.0	4.3	8.7	
1958	2,530	110	51.6	40.0	8.6	10.0	
1959	2,900	136	64.0	49.0	11.5	11.5	
1960	3,320	170	79.5	61.0	16.4	13.2	
1961	3,800	208	94.4	76.0	21.9	15.2	
1962	4,360	253	112.0	94.0	29.3	17.5	
1963	5,000	308	133.1	116.0	38.9	20.1	
1964	5,740	382	157.9	149.0	51.9	23.1	
1965	6,580	463	187.3	180.0	69.4	26.6	

a. In prices of 1 July 1955 converted to the new 1961 rate of exchange.
b. 3/
c. After computations, data were rounded to the nearest million rubles.
d. For the methodology, see Appendix A.
e. 4/

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The relative growth and magnitude of output of industrial electronics and the total electronics industry in the USSR and the US for a number of years are shown in Table 2.* The absolute magnitudes of output of the two industrial electronics sectors differ widely, the Soviet sector amounting to less than one-fourth of that in the US for the year 1958. Furthermore, although annual rates of growth in the USSR will exceed those in the US during the years through 1965, output of the Soviet industrial sector by 1965 will have reached a level near that in the US for the year 1956. Comparisons of US and Soviet ratios of output of industrial electronics with the total for the electronics industry probably give a more significant indication of the inadequacy of the Soviet industrial electronics effort. In the USSR this ratio has been consistently about half of that in the US for the years that can be compared. In fact, not until 1965 will industrial electronics in the USSR reach the proportion of total electronics, about 7 percent, which prevailed in the US electronics industry in 1956. This apparent lag in the Soviet output of industrial electronics has resulted in a low level of use of electronic data-processing equipment, the relatively low level of automation in Soviet industry in general, and an admittedly inadequate volume of production of electronic instruments of many types. The situation can be attributed to the emphasis on Soviet electronics output, which until the mid-1950's was directed first to the military sector, second to the consumer sector, third to the communications sector, and last to the industrial sector. This sequence of priorities was changed with the Sixth Five Year Plan and the Seven Year Plan, and the industrial sector now is enjoying advantages over the consumer and communications sectors.

The composition of the product mix of the industrial sector of the Soviet electronics industry does not differ greatly from that of the US. Computers and data-processing equipment and radio measuring instruments each make up about 40 percent of the total sector both in the US and in the USSR over a number of years. The remaining percentage is divided between industrial controls and medical and scientific electronic devices, neither of which can be measured precisely in the Soviet industrial sector.

The comparisons in value of output do not take into account the differences in the technological level of output of industrial and scientific electronic equipment in the USSR and the US. Although it is not possible to generalize too freely on a technological comparison of Soviet and US industrial electronics, it is valid to say that, in most equipment types within the industrial electronics sectors, the design of US equipment in series production represents a more advanced level of technology than that in the USSR. This difference is borne out by

* Table 2 follows on p. 8.

Table 2

USSR and US: Comparison of Output of the Industrial Electronics Sector and the Electronics Industry a/
1955-61

Million 1955 US $ b/

	1955	1956	1957	1958	1959	1960	1961
Industrial electronics sector							
USSR	80	116	145	184	227	284	346
US	396	522	747	806	964	1,161	1,427
Total electronics industry							
USSR	2,130	2,800	3,500	4,220	4,830	5,530	6,330
US	6,109	6,715	7,837	8,337	9,751	10,805	12,097

a. For the methodology and sources for US data, see Appendix B.
b. Ruble values for Soviet output have been converted to 1955 US dollars at the rate of 0.6 ruble to US $1.

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the practice that has been obvious for many years in the USSR, whereby Soviet equipment designs are directly copied from equipment produced in industrial countries of the West. Exceptions to this comparative lag in technology of series-produced equipment in the USSR can be found in some types of equipment -- analog computers and electronic medical equipment, for example. Soviet analog computers for years have been on a technological level comparable to those produced in the US. Some of the sensing and telemetering devices used in Soviet space flights have shown that the USSR can make microminiaturized instruments and electronic circuits where the need and degree of urgency justifies the expenditures involved. The principal reason for the technological difference between the industrial sectors of the two countries lies in the capability of and the need for US manufacturers to mass-produce equipment having the latest technological developments in order to remain in the highly competitive market of the US electronics industry. The Soviet electronics industry, on the other hand, without the pressure of the normal demand market, has had to adopt measures to require its reluctant industrial enterprises to introduce into series production new equipment incorporating the latest techniques.

C. Production Problems

Production of industrial and scientific electronic equipment in adequate quantities and of sufficiently high quality in the USSR has been hindered by production problems similar to those which have plagued both the electronics industry and the instruments industry. These problems have included the following: (1) inadequate investment in new production facilities, (2) the absence of established standards, (3) problems in coordination between research and manufacturing facilities, and (4) a reluctance at the plant level to introduce new equipment into series production. In addition to these general problems, the producers of industrial electronic equipment possibly have been faced with restrictions on the availability of electronic components.

The most obvious deterrent to the rapid expansion of output has been the inadequacy of available production space. In spite of the increased recognition by those at high levels in the Soviet government of the needs of industry and science for electronic equipment, sufficient attention has not been given to planned investment to provide the necessary additional production capacity. As a result, thus far in the Seven Year Plan, only 5 new plants have started production of industrial electronic equipment out of an estimated total of 70 plants engaged in such production. Four of these five produce industrial controls and measuring instruments, and the other produces X-ray equipment. There are no new plants which produce radio measuring instruments, but new capacity has been made available in already existing instruments plants.

Another factor contributing to the problem of inadequate production capacity has been the inefficient utilization of existing space. That there is a need for specializing production within present plants is best illustrated by the situation in the Tallinn Control and Measuring Instrument Plant, the leading Soviet plant for producing radioisotopic instruments for industrial use. At this plant, 50 percent of output was not related to electronic radioactive devices in 1960, and 15 percent of the total plant output consisted of miscellaneous items such as water-measuring and salt-dosing tanks and test stands for checking automobile ignitions. 5/

The absence of established standards has contributed to the low quality of many Soviet radio measuring instruments and other industrial electronic equipment. It was not until July 1961 that general specifications for radio measuring instruments were established by the State Committee on Standards, Measures, and Measuring Instruments. 6/ There are no known standards for many of the other types of industrial and scientific electronic equipment. The absence of established standards has resulted in a wide variation in the quality of electronic instruments produced in series. Thus, although good Soviet instruments are very good, too often the series-produced instruments are technically substandard. The establishment of standards will in the long run have a salutary effect on the quality of electronic equipment produced, because the manufacturer can be required to conform to the established standards. The immediate results, however, will be an increase in the number of rejects and also in the number of returns of unsatisfactory instruments. Eventually, manufacturing techniques will be improved so as to raise the quality of the instruments to the desired level.

The problems of coordination between the design institutes and the manufacturing facilities have arisen from the physical separation of the two. In addition, there is a psychological separation between the designer in the research institute and the plant engineer in the manufacturing plant. Several enterprises have indicated the failure on the part of scientific research institutes to coordinate adequately the steps between the development of prototypes and series production. The resultant lag between development and series production for an item of equipment is a problem which prevails throughout the Soviet electronics industry. The State Committee for Electronic Technology was created in 1961 to treat with this problem as it affects the introduction of new technology in the electronics industry. Other state committees and the sovnarkhozes have been charged with eliminating conditions which contribute to this problem, but it is too early to determine whether any effective measures have been taken.

Economic factors have influenced greatly the nature of output of each plant. Without the effective pressure of consumer demands and

with the inflexible centralized planning, electronic equipment incorporating inferior or obsolete designs and varying in operating characteristics from the desired standards often remains in series production long after the demand has diminished. Initiating the series production of new equipment requires investment expenditures for retooling, results in an immediate drop in plant output during the retooling period, and is accompanied by a loss in productivity during the initial phases of new production. Special plant funds have been provided to cover the costs of initiating new series production, but this aid has not afforded an incentive sufficient to encourage the introduction of new technology into production on any broad scale. The major emphasis in the plant has been on continuing the annual increases in value of plant output. Because it is much easier to increase the value of output by manufacturing items already in production, the tendency has been to resist the introduction of new types of equipment. Here again, the experience at the Tallinn plant affords an example of a situation which undoubtedly is repeated in other plants. The Tallinn plant found itself unable to fulfill output quotas unless it either continued production of obsolete items of equipment or rushed new equipment into series production without adequate developmental work. 7/ In either instance, the pressure on individual plants to fulfill the value goals for output resulted in a waste for the total economy, because production consisted of a large percentage of either unwanted or substandard equipment. The sovnarkhozes, moreover, which establish the production goals for individual enterprises, have failed to provide effective leadership in adjusting the product mix to consumer requirements.

There is no direct evidence that the unavailability of specific electronic components has hindered production of industrial electronic equipment, although such is believed to be the case. It is known, for example, that the Soviet output of active electronic components did not fully satisfy the needs of the electronics industry during the first half of the 1950's, and this could well have had a limiting effect on the design of equipment incorporating electronic circuits for industrial use. Since 1960, there has been a noticeable increase in the number of industrial controls and medical and scientific instruments designed around semiconductor devices. This increase is very likely related to a planned availability for these components which did not exist before that time. There is evidence, however, that the volume of output of transistors and other semiconductor devices has not increased at the desired rate in the USSR. The probability exists, therefore, that there are problems concerning the availability of the electronic components needed to insure planned increases in output within the industrial sector. It has been noted that for the most part, to date, these newly designed items of electronic industrial equipment are not in large series production but rather are produced for a limited number of users. This has been true, for example, in the case of

electronic computers: transistorized digital computers were not in series production until 1962, although development of the Razdan, an all-transistor digital computer, was completed in 1960.

It is estimated that the future will bring increased use of standardized component units in the manufacture of industrial electronic equipment. For example, units for power supplies, measuring circuits, radiation sources, recording, and data read-out can be standardized for use in a wide variety of automated systems. The extended use of semiconductor devices and printed circuits will simplify manufacturing processes and, along with standardization, will contribute to the need for increased productivity in the existing production facilities.

III. Production of the Industrial Sector, by Branch

A. Radio Measuring Instruments

Production of radio measuring instruments in the USSR, as in other countries, has been largely an outgrowth of production of electrical test and measuring instruments but also has been derived from the application of new electronic technology to conventional measuring techniques. The USSR achieved a rapid expansion in production of radio measuring instruments during 1950-60, and the relatively high rate of growth of this output is expected to continue through the Seven Year Plan. The expansion in output of radio measuring instruments paralleled the Soviet expansion in production of electronic equipment during the years through 1958 but is expected to exceed the growth in electronics during the Seven Year Plan. Thus the value of output of radio measuring instruments in 1965 is to be about 3.6 times that of 1958, whereas the value of output of the total electronics industry is to be 2.6 times that of 1958 and the instruments industry 3.2 times.

Radio measuring instruments represent the largest single class of industrial and scientific electronic equipment in terms of value of output. This predominance of output of radio measuring instruments over that of other classes in the industrial sector will continue through 1965, even though output of two of the other classes of this equipment will be increased at a more rapid annual rate. In 1958, for example, radio measuring instruments made up about 47 percent of the total output estimated for industrial electronic equipment, whereas by 1965 this figure is expected to drop to 40 percent. The demand has been present in the USSR for the continued rapid expansion of production of radio measuring instruments. Thus far in the Seven Year Plan, however, the annual increments to production have not been adequate to satisfy either the quantity or the quality requirements of Soviet industry and science.

No coherent body of statistics is available on the Soviet production of radio measuring instruments. These instruments generally are treated in the classification of Soviet instruments as a subgroup of electrical measuring instruments, called radioizmeritel'nyye pribory. It has been possible, however, on the basis of announced indexes and analogy with the comparable US production, to estimate the value of output of radio measuring instruments for selected years as follows*:

Million Rubles

1950	1955	1958	1959	1960	1961	1962	1965
4.6	26.8	51.6	64.0	79.5	94.4	112.0	187.3

The USSR manufactures a wide variety of radio measuring instruments. A recent compilation, which was by no means exhaustive, listed about 270 Soviet instruments comprising the main types necessary to support radioelectronics research, production, and maintenance. 8/ Included among these 270 Soviet instruments were frequency meters, wavemeters, Q-meters, standing wave indicators, modulation meters, oscilloscopes, power meters, vacuum tube voltmeters, signal generators, and several other categories. The technical parameters and circuit diagrams for many of these Soviet radio measuring instruments have been published in several books, two of which are cited below.** Equipment listed in these publications represents standard measuring instruments which are generally available and are produced in series. These books do not include instruments developed or manufactured in research institutes or design bureaus for a specific use and are not considered representative of the most recent Soviet state-of-the-art. It is evident, however, from the available data that series-produced radio measuring instruments are currently of a lower technological level than those produced in the West.

The small number of Soviet plants manufacturing radio measuring instruments are not able to supply adequately the domestic demands,

* For the methodology used in deriving these estimates, see Appendix A.

** Shkurin, G.P., Spravochnik po elektroizmeritel'nym i radioizmeritel'nym priboram, radioizmeritel'nyye pribori (Handbook on Electrical Measuring and Radio Measuring Instruments: Radio Measuring Instruments), Moscow, Ministry of Defense Publishing House, 1960; Osipov, K.D., and Pasynkov, V.V., Spravochnik po radioizmeritel'nym priboram (Handbook on Radio Measuring Instruments), Moscow, Soviet Radio Publishing House, 1959.

either in quantity or quality. There are only eight plants which account for the majority of radio measuring instruments produced in the USSR, and output of radio measuring instruments within these plants makes up varying proportions of their total output. For example, about 75 percent of output of the Moscow Manometer Plant is made up of electronic instruments, whereas output of the Leningrad Vibrator Plant is made up almost entirely of electrical measuring instruments. Three of the eight plants are plants of the former radiotechnical industry -- the Tallinn Punane Ret Radio Plant, the Vil'nyus Radio Plant No. 555, and the Minsk Radio Plant imeni Molotov. The others are plants of the instruments industry: the Moscow Tochelektropribor Plant, the Moscow Manometer Plant, the Kiev Tochelektropribor Plant, and the Leningrad Vibrator Plant, and the L'vov Instrument Plant. In addition to these eight major plants, radio measuring instruments are manufactured in many electronics plants and other industrial facilities where they are used. In spite of the inadequacy of production space, there have been no plants constructed during the Seven Year Plan solely for the manufacture of radio measuring instruments. Continued growth in output of radio measuring instruments is predicated on increased productivity and the allocation of additional production space within existing instrument-making facilities. The productivity increases which have been called for in the Seven Year Plan are to be achieved by the standardization of designs and increased mechanization of manufacturing processes, neither of which has progressed very far to date.

In order to supplement inadequate domestic production, the USSR continues to import radio measuring instruments from East Germany, Hungary, and Czechoslovakia. In addition, to make up for the lag in technology behind the West, the USSR tries to purchase the most recent developments in Western instruments. The following is a listing of electronic measuring instruments for which the Soviet authorities have made numerous purchase inquiries during 1961-62:

Oscilloscopes of 30 megacycles per second bandwidth and above,
Impedance bridges,
Power output meters,
Recording millivoltmeters,
Signal generators in the range 4-12 gigacycles per second,
Vacuum tube or transistor voltmeters, and
Low-frequency test instruments down to 2 cycles per second.

Although these expressions of interest on the part of the USSR cannot be interpreted as the absence of production of such instruments domestically, they do indicate areas in which domestic production is weak.

B. Electronic Industrial Control Equipment

Electronic industrial control equipment is a miscellaneous class of electronic equipment that is defined to cover the growing number of instruments, controls, and telemetering devices which use electronic components in circuits designed to measure parameters, relay data, or regulate industrial processes. The Seven Year Plan calls for a rapid increase in production of all information-processing and control devices for industrial use. The growing significance of electronics in automation, guidance systems, and communications techniques assures an ever-increasing demand for electronic amplifiers, relays, data converters, instruments, and telemetering equipment. As a result, the planned rate of growth in output of the total class of industrial control equipment has been higher than for any other class within the industrial sector, averaging about 34 percent annually during the Seven Year Plan. Because of this anticipated rapid growth, during the Seven Year Plan the percent of the total industrial sector represented by industrial control equipment will increase from 8 in 1958 to about 15 in 1965. Data on production for the years before 1958 can be derived only by extrapolation, but it is certain that before 1955 the value of output of this class of electronic equipment was very small relative to output of the total industrial sector.

Production data are not available for each general type of equipment included in this class. The value series derived to represent output of this equipment therefore is a minimum estimate consisting of the sum of the values of output of electronic process control devices and of radioisotopic instruments. A tentative value series for output of electronic process control devices has been derived on the basis of the value of output of all process control instruments and an estimate of the proportion of this figure which would represent the value of the electronic components therein.* The value of output of radioisotopic instruments for selected years has been estimated on the basis of production data for the major producing plant, the Tallinn Control and Measuring Instrument Plant. The derived series are as follows:

Million Rubles

	1958	1959	1960	1961	1962	1965
Electronic process control devices	8.6	11.5	15.4	20.6	27.6	66.3
Radioisotopic instruments	Negl.	Negl.	1.0	1.3	1.7	3.1
Total	8.6	11.5	16.4	21.9	29.3	69.4

* For the methodology, see Appendix A.

As can be seen, the greater portion by value for the class of industrial control equipment is included under the type of electronic process control devices. This term defines a large number of electronic devices which are being incorporated in semiautomatic and automatic control systems for use in almost every sector of Soviet industry. For the most part, this control equipment is produced in plants of the instruments industry and is designed to serve a particular using industry. The equipment varies in nature from electronic regulators, which are placed on line to control the flow of inputs for an industrial process, to that equipment for telemetering systems which can control inputs or the flow of materials over great distances. Data-processing equipment such as large electronic data loggers are specifically excluded from this class of equipment but rather are included in the class of computers and associated equipment.

Approximately 30 plants are engaged, at least in part, in manufacturing electronic industrial control devices. The large number of these plants is an indication of the current emphasis which the USSR has afforded production of equipment designed to increase industrial productivity but is misleading as to the absolute volume of the current output of this equipment. Most of the above plants are engaged only partly in production of electronic industrial controls, and in many instances the controls reported on in this category represent prototypes rather than equipment in series production. It is obvious, however, that the number of facilities for production of industrial controls has increased substantially since 1958 and that output of these controls has had a similar expansion. Of the 30 plants, at least 6 either have been newly constructed for production of industrial electronic controls or have initiated production of such equipment within the past few years.

The USSR has directed considerable attention to the use of radioisotopic devices in a large variety of industrial measuring processes. As a result, production of these instruments has been increased appreciably since 1955. Although series production did not exist to any great extent until about 1960, there are now 12 plants producing some type of instrument or measuring equipment using radioactive isotopes, and there are estimated to be 20 to 30 different types of these devices. Radioisotopic measuring units have been incorporated in thickness gauges for rolled products of metals, glass paper, or plastic; in liquid level indicators in processes involving the measurements of corrosive or high-temperature liquids; and in scales to measure the weight and density of substances being processed in a continuous moving line operation. Radioisotopic instruments are being used in the USSR primarily in metallurgy, food processing, textiles, and the chemical industry.

The Tallinn Control and Measuring Instrument Plant is the major producer of measuring instruments based on radioactive isotopes and is estimated to manufacture 70 to 80 percent of the total of these instruments. 9/ Others of the 12 plants credited with manufacturing instruments using radioactive measuring devices are plants which specialize in producing equipment for a particular industry. For example, the Khar'kov Teploavtomat Plant produces radioactive isotopic instruments for testing in metallurgy; the Tekstil'mashpribor Control and Measuring Instruments Plant makes radioactive isotopic level-measuring indicators for the textile industry; and the Barnaul Geophysical Apparatus Plant and the Moscow Neftepribor Plant make instruments incorporating gamma ray emitters for use in geological prospecting. It is probable, however, that these plants use standard devices which are manufactured by the Tallinn plant.

Closed-circuit television is another electronic device used in the automation of many processes in Soviet industry as well as in other sectors of the economy. Television has been applied successfully in Soviet machine building industries and in metallurgy, mining, transportation, and electric power. Industrial television equipment has been in series production in the USSR since 1957. As in the case of other electronic components for automation, however, industrial television equipment has not been produced in quantities sufficient to permit maximum utilization even in areas where experimental use has proved its desirability.

The Moscow Television Plant has been producing industrial television systems since 1957. 10/ In addition, television systems have been developed in many of the institutes of using industries. For example, an experimental plant of the Construction Bureau of the Main Administration of Signaling and Communications of the Ministry of Railroad Transportation constructed two television systems for experimental use on rail marshaling yard tracks in Moscow. 11/ Similarly, the Khar'kov Polytechnic Institute has constructed a television set for use in machining operations. 12/ Because of this pattern of end use widely scattered throughout many industries, it has not been possible to measure the value of output of Soviet industrial television equipment for any one year.

C. Medical and Scientific Electronic Equipment

The general class of medical and scientific electronic equipment is meant to include electronic equipment used in medicine for research, diagnosis, or therapy; electronic equipment used in geology and meteorology for assessing the makeup of the earth's crust or of its atmosphere; and those nonstandard electronic instruments used in scientific research. Although the value of output of scientific electronic

equipment has not reached significantly large proportions compared with output of the other classes of industrial electronics, it is apparent that electronics plays an increasingly important role in current Soviet developments in these fields and that the rate of growth for output of this equipment probably is at least comparable to that for the Soviet electronics industry during the Seven Year Plan.

About the only measure of the scale of output of various types of scientific and medical electronic equipment is the number of plants involved. For this type of electronic equipment, however, a relatively large volume of production of special-purpose instruments is carried out in research and development laboratories and in medical facilities themselves. There are 10 Soviet plants which produce medical electronic X-ray equipment and other medical research instruments. Moscow, Leningrad, and Kiev are the principal producing centers. In addition, there are plants in Aktyubinsk, Sumy, and Tartu. Of these 10 plants, 5 produce X-ray equipment, of which one, the Tarturentgen Plant, is a newly organized plant. Industrial X-ray equipment is produced also at the Moscow Teply Stan Mosrentgen Plant. The Sumy Electron Microscope Plant in Sumy manufactures electron microscopes, but their quality and quantity have not been adequate to obviate the need to import some of this equipment from Japan in recent years. Output at the Leningrad Krasnogvardeyets Plant, a medical equipment plant, is to be increased by 74 percent during the Seven Year Plan, and the product mix at the plant is to be changed to provide an increased output of electronic medical apparatus. 13/ Production of medical electrical and electronic equipment at the Moscow Elektro-Meditsinskoy Apparatury (EMA) Plant is to be increased 80 percent during the Seven Year Plan. 14/ These announced individual plant goals can be extrapolated to indicate a minimum annual growth for all types of medical apparatus -- electrical, mechanical, and electronic -- of between 8 and 9 percent. Inasmuch as output of electronic equipment for medical use is expected to be increased at the expense of other types of medical apparatus, the rate of growth for electronic equipment would be higher and probably would approximate the rate for the electronics industry of 15 percent.

Electronic equipment for geological and meteorological uses is produced in nine plants, of which four are in the Moscow area and one is in Leningrad. The other facilities are located in Riga, Baku, Barnaul, and Sverdlovsk. None of these plants is a new plant, although production of electronic equipment has been introduced, for the most part, in recent years. Isotopic measuring devices incorporated in instruments for geological prospecting and for measurements of radiation in the atmosphere are manufactured in four of these plants. The Sverdlovsk Hydrometeorological Instruments Plant is an important producer of radiosondes which measure, record, and transmit data on the temperature,

humidity, and density of the atmosphere. Radiosondes are produced also in the Riga Gidrometpribor Plant. There is no measure of the magnitude of the value of output of electronic equipment for geological and meteorological use, but it is estimated that their value is small even relative to output of medical electronic equipment.

An estimated value of output for electronic medical equipment of about 10 million rubles in 1958 has been derived based on US analog data for production of X-ray equipment as related to the value of output of all electrical instruments.* This is a tenuous relationship, and the margin of error is high. It is estimated, therefore, that the value derived for output of X-ray equipment represents the general magnitude of the value of output for the entire category of medical and scientific electronic equipment. Projected at an annual rate of 15 percent during the Seven Year Plan, it is estimated that in 1965 this output will have reached a value of about 27 million rubles, or about 6 percent of the industrial sector.

D. Computers and Related Data-Processing Equipment

The value series for output of computers and related data-processing equipment has been taken directly from CIA/RR ER 61-11, Production of Electronic Computers in the USSR, 1958-65, March 1961, SECRET.

* For the methodology, see Appendix A.

APPENDIX A

METHODOLOGY

1. Value of Output of Radio Measuring Instruments

The estimated value series for output of radio measuring instruments has been derived from (1) information concerning the Soviet planned output of these instruments for 1955 and 1960 compared with output in 1950, (2) the relationship which has prevailed in the US electronics industry between production of electronic measuring instruments and the total output of electronics, and (3) certain assumptions about the Soviet reporting of output of instruments.

An index of production for radio measuring instruments for 1950-60 has been made on the basis of a plan figure published in 1956 which called for an output of these instruments in 1960 that would be 16.5 times as great as in 1950. 15/ A subsequent report indicated that output of radio measuring instruments in 1955 was 5.6 times that of 1950. 16/ From these two statements it was calculated that the average annual rate of growth for radio measuring instruments during 1951-55 was slightly more than 41 percent and during 1956-60 was planned to be about 24 percent. The resulting indexes for the 10-year period, using 1950 and 1958 as base years, are as follows:

Year	1950 = 100	1958 = 100	Year	1950 = 100	1958 = 100
1950	100	9	1956	695	65
1951	141	13	1957	862	81
1952	199	19	1958	1,070	100
1953	281	26	1959	1,328	124
1954	396	37	1960	1,650	154
1955	560	52			

In the absence of statistics on actual or planned production of radio measuring instruments for the years beyond 1960, an index has been constructed by taking into consideration factors which would influence the planned production of these instruments. As a base for this index the growth in output which was derived above for 1959 and 1960 has been extended on a straight line to 1965. This projects an annual rate of growth of 24 percent which is greater than has been the actual rate of growth for all instruments during 1960 and 1961 and is greater than the estimated rate of growth for the total electronics

industry during the current plan period.* To adjust the straightline projection for electronic instruments to reflect influences of the electronics and instruments industries, indexes for the 1965 output of the electronics industry 17/ and of the instruments industry 18/ have been averaged with the index based on the projection, as follows:

	1960	1965
Radio measuring instruments index	100	294
Index for the electronics industry	100	198
Index for the instruments industry	100	216**
Mean average index***	100	236

The mean average index thus reflects factors exerting a downward influence on the rate of growth. Such factors would include the limited availability of components such as electron tubes and semiconductor devices, which are products of the electronics industry, and also the limited availability of precision measuring components for radio measuring instruments, which are products of the instruments industry. Conversely, the factors which might exert an upward influence on output of radio measuring instruments (compared with the rate of growth for the electronics industry as a whole) would be the rapid growth in the requirements for radio measuring instruments brought about by the Soviet drive for automation of industry and the fact that the USSR has not succeeded in satisfying the demands of domestic users with the rate of output which has prevailed in the past.

Using the derived average annual increase for 1961-65, the earlier index for radio measuring instruments can be extended to cover the years through 1965, using 1958 as a base year, as follows:

Year	1958 = 100	Year	1958 = 100
1958	100	1962	217
1959	124	1963	258
1960	154	1964	306
1961	183	1965	363

* Although the reduced plan goals for the electronics industry which were introduced in the Seven Year Plan might suggest a rate of growth for radio measuring instruments lower than the 24 percent for 1959-60, the actual output of the instruments industry in 1959 (which was 27 percent above output in 1958) indicates that the rate of growth of 24 percent was possible.

** Lower limit of a range of 216 to 225.

*** The arithmetic mean was used rather than the geometric mean because the latter would have had an even greater downward influence.

The value of output of radio measuring instruments for the base year has been derived in the following manner. According to data on the US electronics industry, the value of output of test and measuring instruments (comparable with the Soviet radio measuring instruments) during 1954-59 ranged from 2.0 to 2.8 percent of the total output of the electronics industry. 19/ Inasmuch as this factor has remained fairly constant during the 6-year period in the US electronics industry, it is considered a valid factor to apply also to the Soviet electronics industry. The US factor for 1954, 2.04 percent, applied to the value of output of the Soviet electronics industry for 1958, 2.53 billion rubles, gives a value of output for radio measuring instruments of 51.6 million rubles. The 1954, or lowest, US factor was considered most appropriate for application to the Soviet industry output in 1958 because the Soviet electronics industry is estimated to lag behind the US electronics industry in most areas of production and because the USSR has been chronically short of radio measuring instruments -- a condition which has not prevailed in the US.

A second, and somewhat more involved, methodology provides a rough check on the order of magnitude of the above estimate. In the USSR in 1958, electrical measuring instruments accounted for 13 percent of the total production of instruments, 20/ or 96 million new rubles (that is, 13 percent of 739 million rubles). 21/ Taking from US statistics the relationship which existed between output of electrical measuring instruments and radio measuring instruments (a ratio of about 2 to 1, which existed in 1954 and 1958 22/) and applying this ratio to the above-calculated Soviet output of electrical measuring instruments gives an estimated value of output for radio measuring instruments for 1958 of about 48 million rubles. This figure is close enough to the other derived estimate of 51.6 million rubles to lend credence to the former estimate.

The value series, using the base-year estimate of 51.6 million rubles and the derived index for radio measuring instruments, is as follows:

Million Rubles							
1950	1955	1958	1959	1960	1961	1962	1965
4.6	26.8	51.6	64.0	79.5	94.4	112.0	187.3

2. Electronic Industrial Control Equipment

Data on the value of output of electronic industrial controls are believed to be included in the Soviet statistics on instruments under

the subclass process control instruments. At the least, the electronic amplifiers and signal processing devices which are included in industrial control systems would be included in statistics on process control instruments. For this reason and in the absence of specific output data, the high rate of growth which was planned in the goals of the Seven Year Plan for process control systems has been considered applicable as a rate of growth for output of industrial electronic control devices. Thus process control instruments in 1958 were 11.7 percent of the total output of instruments, 23/ or 86.5 million rubles. By 1965 these process control instruments are to be 27.8 percent of the total output of instruments, which has been estimated at 2.4 billion rubles,* 24/ or 667 million rubles. These two terminal value figures yield an average annual rate of growth for process control instruments of 33.9 percent. A value for the electronic portion of the total process control instruments in 1958 has been estimated at 10 percent, or 8.6 million rubles. Using the derived annual rate of growth and the value for 1958, the following value series for electronic industrial control equipment has been derived:

Million Rubles

1958	1959	1960	1961	1962	1963	1964	1965
8.6	11.5	15.4	20.6	27.6	37.0	49.5	66.3

As in the case of radio measuring instruments, there have been no announced output statistics for control instruments to indicate whether this substantial estimated rate of growth has been achieved thus far in the Seven Year Plan. There are, however, announced statistics of output of instruments and automation equipment for a few of the Soviet republics, as shown in the tabulation below, which indicate that the achievement of such goals might be possible in production of electronic control devices, bearing in mind that industrial controls are being emphasized during the Seven Year Plan:

* Lower limit of a range of 2.4 billion to 2.5 billion rubles.

Area	Class of Equipment	Period of Report	Percent of Increase Above Previous Year
Kiev Sovnarkhoz	Automation equipment	First 5 months 1962 (actual)	26
Ukrainian SSR	Instruments and automation equipment	1962 (plan)	25
Estonian SSR	Instruments, automation equipment, and spares	1961 (actual)	33
Lithuanian SSR	Instruments, automation equipment, and spares	1961 (actual)	20

The value series derived for output of radioisotopic instruments has been based on the reported output of the Tallinn Control and Measuring Instrument Plant, which produces from 70 to 80 percent of the total of such equipment in the USSR. Output of these instruments at the Tallinn plant in 1960 was slightly less than 0.7 million rubles, and the planned output for 1965 has been reported to be 2.5 million rubles. 25/ The average annual rate of growth of this portion of the plant's output, therefore, is 29 percent. The value series using this rate of growth during 1960-65, divided by the percent of the total Soviet output of these instruments, gives the following value series for the total Soviet output of radioisotopic instruments:

	1960	1961	1962	1963	1964	1965
Output at Tallinn (million rubles)	0.7	0.9	1.16	1.50	1.94	2.50
Percent of total	70	70	70	80	80	80
Total USSR (million rubles)	1.0	1.3	1.7	1.9	2.4	3.1

3. Medical and Scientific Electronic Equipment

To derive a tentative estimate of the value of output of medical and scientific electronic equipment, US analog data have been resorted to in the complete absence of meaningful Soviet data. In 1958 the US output of X-ray equipment, exclusive of industrial X-ray, was

reported to be $67 million, which is about 22 percent of the total output of electronic radio measuring instruments ($311 million) reported in the same source. 26/ Inasmuch as neither X-ray equipment nor radio measuring instruments represent new equipment in series production in the USSR, it has been assumed that a comparable relationship exists between the respective outputs. Therefore, it is estimated that 11.4 million rubles would represent the derived value of Soviet X-ray equipment for 1958 (22 percent of 51.6 million rubles). Because of the probable high margin of error in this methodology, it has been decided that the resultant value of Soviet X-ray equipment should be rounded to 10 million rubles and that this estimate would include the value of output of other electronic scientific equipment within the margin of error. A rate of growth of 15 percent, which is comparable to that for the Soviet electronics industry, has been accepted, and the following very tentative value series for this class of equipment has been derived:

Million Rubles							
1958	1959	1960	1961	1962	1963	1964	1965
10.0	11.5	13.2	15.2	17.5	20.1	23.1	26.6

APPENDIX B

COMPARISON OF GROWTH IN INDUSTRIAL ELECTRONICS IN THE USSR AND THE US

Direct comparisons of rates of output in the Soviet industrial electronics sector with those in a similar sector of the US electronics industry are difficult because of problems in comparability of statistical data. Several sources of US statistics provide varying value figures for classes of electronic equipment which in themselves are not too clearly defined. In addition, there is an absence of detailed statistical data on the US sector for any years after 1958. For that year, the US Census of Manufactures, published by the Bureau of the Census, 27/ provides statistical coverage on industrial equipment which makes it possible to construct an industrial electronics sector for the US which can be compared with the derived Soviet sector. The yearbooks of the Electronic Industries Association (EIA), on the other hand, contain data for industrial electronics for 1950-61, but only the yearbooks for 1958 and 1961 provide enough detail to develop values for the several classes of equipment which can be compared directly with those derived for the Soviet industrial electronics sector. Furthermore, statistics of the EIA, because of the broader definition of the sector, differ from those developed from the Census of Manufactures. A combination of the best of both series has been made for comparative purposes, using the Census data for 1958 to determine the value of the US sector for a base year and using the rates of growth indicated by the EIA statistics to derive a US series for 1955-61. Production of the US electronics industry is available only through 1961. It is sufficient, however, to make the comparisons for the earlier years to establish the relationships between the two industries, which would remain fairly constant through 1965.

The tabulation that follows on the next page is US Census of Manufactures data for 1958, grouped according to the Standard Industrial Code (SIC) classification, showing comparable data for the USSR where such is available.

US SIC Number	US Class	Soviet Class	Value (Million US $) US	USSR
3571212	Electronic computing and associated information processing equipment	Electronic computers and associated equipment	324	67
36112	Equipment for testing electrical radio and communications circuits	Radio measuring instruments	311	86
3622051	Electronic industrial controls other than resistance welding, including automatic control equipment	Industrial control	40	14
3662241	Industrial television, including cameras	Industrial television	8	N.A.
3662621	Ultrasonic equipment	Ultrasonic detectors	43	N.A.
3567313	Radio frequency induction		7	N.A.
3693	Radiographic X-ray	Medical and scientific	67*	17

The above US Census data leave out geophysical and meteorological electronic equipment and nuclear electronic equipment. Most of the electronic geophysical and meteorological equipment is included in a larger miscellaneous category in the Census under SIC Number 3662651, "Other transmitting, signaling, and detection equipment, including electronic meteorological equipment and systems (ray-wind, radiosonde, etc.); facsimile equipment (except telegraph); etc." The data on nuclear electronic equipment do not appear, as such, anywhere in the Census statistics. Because of these omissions and because the statistical coverage of data in the Census includes from 80 to 90 percent of output of the several classes of equipment, the value of the US industrial electronics sector derived from the Census of Manufactures represents about 80 percent of the total. This figure is to be compared with the coverage in the derived Soviet sector, where values for certain types of equipment are not available.

* Excluding industrial X-ray and radiographic equipment worth $6 million.

From the EIA data, the values of the annual output of industrial electronics, excluding the values for industrial communications and commercial sound equipment but including a miscellaneous figure, provide the following index for 1955-61. This index applied to the value of output for 1958 as given in the Census of Manufactures gives a value series which can be compared with that derived for the USSR:

	1955	1956	1957	1958	1959	1960	1961
Index (1958 = 100)	49.1	64.8	92.7	100.0	119.6	144	177
Value (million US $)	396	522	747	806	964	1,161	1,427

APPENDIX C

GAPS IN INTELLIGENCE

The gaps in information on the Soviet production of industrial and scientific electronic equipment are numerous. Briefly stated, there is an almost complete absence of aggregate data on output of equipment in the industrial sector, and there is a scarcity of meaningful data on output of specific plants and on the volume of output of specific types of electronic equipment within the industrial sector. In addition, there is no quantitative data on trade in this equipment and very little on investment at producing facilities.

The availability of data varies from one class of equipment to another, as can be seen in the methodologies used above. The estimate of output of electronic computers, for example, is based on an announced plan goal for the Seven Year Plan, and the estimate for output of radio measuring instruments goes farther back to the announced plan goal for 1950-60. For neither of these classes of equipment, however, are absolute production data announced, either for a plan period or for any year in the plan. Moreover, neither absolute nor relative statistics are published on output of industrial control equipment or medical and scientific electronic equipment for any measured period.

The most probable reason for the absence of any aggregate output data on radio measuring instruments, industrial control devices, and medical and scientific equipment is that there is a real problem in compiling statistical data on these classes of equipment. At the Gosplan, or aggregative, level, these miscellaneous electronic equipments could be classified in several ways besides the classification which was adopted for this project. Radio measuring instruments, therefore, might be classified as electrical instruments, electronic control devices might be electric industrial apparatus, and medical electronic equipment might be classed under miscellaneous electrical products. These are, in fact, the general headings under which comparable US electronic equipments are found in the US Census of Manufactures. It is known that the Soviet capability for handling aggregative statistical data on a timely basis is limited by the small number of electronic computers allocated to this work and by the small number of accounting machines in use at the lower levels of reporting. Therefore, it is possible that statistical data on subgroups of equipment in the industrial sector are not being compiled on an annual basis.

Data at the subaggregative level are somewhat more available but appear to be carefully screened, so that a complete and current estimate

of the level of production for any type of equipment cannot be made. There are great gaps in time, for example, between the announced initiation of series production for a particular item of equipment and any subsequent announcements of the volume of output. The absence of details on the product mix of major producing plants also represents a serious gap, for output of many plants includes a wide variety of equipment of which only a portion would be industrial electronic equipment. Similarly, value data on investment at the plant level are seldom available. It appears that Soviet data can be published on output of electronic equipment providing (1) that there are no readily discernible military implications and (2) that output would not reflect adversely on the Soviet effort when compared with that of non-Bloc countries. These restrictions effectively cut off from publication meaningful data on output within the industrial sector, where there are lags in technology and in the volume of output and where some of the equipment has a dual industrial-military end use.

APPENDIX D

SOURCE REFERENCES

Evaluations, following the classification entry and designated "Eval.," have the following significance:

Source of Information	Information
Doc. - Documentary	1 - Confirmed by other sources
A - Completely reliable	2 - Probably true
B - Usually reliable	3 - Possibly true
C - Fairly reliable	4 - Doubtful
D - Not usually reliable	5 - Probably false
E - Not reliable	6 - Cannot be judged
F - Cannot be judged	

"Documentary" refers to original documents of foreign governments and organizations; copies or translations of such documents by a staff officer; or information extracted from such documents by a staff officer, all of which may carry the field evaluation "Documentary."

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Except for CIA finished intelligence, all sources are evaluated RR 2.

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